The club was organized in the autumn of 1905. The first officers were: President, Professor Robert E. Moritz; secretary, Professor Frank M. Morrison. The monthly meetings of the club were devoted to reviews, current mathematical literature and reports on original work.

PROBLEMS AND SOLUTIONS.

EDITED BY B. F. FINKEL AND OTTO DUNKEL.

Send all communications about problems and solutions to B. F. FINKEL, Springfield, Missouri.

PROBLEMS FOR SOLUTION.

2799. Proposed by H. C. BRADLEY, Massachusetts Institute of Technology.

A newspaper recently gave this problem: Cut a regular six-pointed star into the fewest number of pieces which will fit together and make a square. The newspaper gave a solution in seven pieces. First cut off two opposite points of the star. Divide each into two parts, and fit to the remaining portion of the star so as to make a reetangle. Find the mean proportional between the length and breadth of this rectangle (construction not shown); this is the side of the required square. Using this dimension on the two long sides of the rectangle, divide the latter into three pieces, which make the square. Total seven pieces.

How may the square be formed with not more than five pieces?

2800. Proposed by A. M. HARDING, University of Arkansas.

If $x + y + z = xyz$, show that

$$\frac{2x}{1-x^2} + \frac{2y}{1-y^2} + \frac{2z}{1-z^2} = \frac{2x}{1-x^2} \cdot \frac{2y}{1-y^2} \cdot \frac{2z}{1-z^2}.$$

2801. Proposed by A. S. HATHAWAY, Rose Polytechnic Institute.

A dog at the center of a circular pond makes straight for a duck which is swimming along the edge of the pond. If the rate of swimming of the dog is to the rate of swimming of the duck as $n:1$, determine the equation of the curve of pursuit and the distance the dog swims to catch the duck.

2802. Proposed by WARREN WEAVER, Throop College of Technology.

Consider two circles, each of radius k, with centers at $(0, 0)$ and $(k', 0)$ respectively, where k' is less than k. Through the point $(k', 0)$ draw a ray making an angle θ with the positive x-axis. Call the intersection of this line with the first circle A, and with the second circle B. Extend the line through the point $(k', 0)$ in the opposite direction, and call the intersection of this extension with the first circle A', and with the second circle B'. Prove that the sum of the two segments AB and $A'B'$ is independent of k, and depends only upon k', i. e. the shift of the circles, and θ.

2803. Proposed by S. A. COREY, Des Moines, Iowa.

In the November, 1918, number of the *Proceedings of the Edinburgh Mathematical Society* (Vol. 36, part 2, page 103), Professor Whittaker gives the following formula for the solution of algebraic and transcendental equations:

The root of the equation

$$0 = a_0 + a_1x + a_2x^2 + a_3x^3 + a_4x^4 + \cdots,$$

which is smallest in absolute value, is given by the series

$$-\frac{a_0}{a_1}-\frac{a_0^2a_2}{a_1\begin{vmatrix}a_1a_2\\a_0a_1\end{vmatrix}}-\frac{a_0^3\begin{vmatrix}a_2a_3\\a_1a_2\end{vmatrix}}{\begin{vmatrix}a_1a_2\\a_0a_1\end{vmatrix}\begin{vmatrix}a_1a_2a_3\\a_0a_1a_2\\0\ a_0a_1\end{vmatrix}}-\frac{a_0^4\begin{vmatrix}a_2a_3a_4\\a_1a_2a_3\\a_0a_1a_2\end{vmatrix}}{\begin{vmatrix}a_1a_2a_3\\a_0a_1a_2\\0\ a_0a_1\end{vmatrix}\begin{vmatrix}a_1a_2a_3a_4\\a_0a_1a_2a_3\\0\ a_0a_1a_2\\0\ 0\ a_0a_1\end{vmatrix}}-\cdots.$$

In case of any algebraic equation with imaginary or complex roots the above formula clearly fails. State the conditions under which the formula may be relied upon to give correct results.

2804. Proposed by T. H. GRONWALL, Washington, D. C.

Show that for $|x| < 1$

$$\frac{1}{\sqrt{1-x^4}}\int_0^x\frac{dx}{\sqrt{1-x^4}}=x+\sum_1^\infty\frac{3\cdot7\cdots(4n-5)(4n-1)}{5\cdot9\cdots(4n-3)(4n+1)}x^{4n+1},$$

$$\left(\int_0^x\frac{dx}{\sqrt{1-x^4}}\right)^2=x^2+\sum_1^\infty\frac{3\cdot7\cdots(4n-5)(4n-1)}{5\cdot9\cdots(4n-3)(4n+1)}\cdot\frac{x^{4n+2}}{2n+1}.$$

2805. Proposed by C. N. MILLS, Brookings, S. Dakota.

Derive the expression for volume

$$v=\int\int\int\rho^2\sin\phi d\rho d\phi d\theta.$$

In Byerly's *Integral Calculus*, page 183, revised edition, is a method by revolution, and in Czubers's *Integralrechnung*, page 200, is a method using the Jacobian determinant.

Required, a simple method one might use in developing the volume integral in polar coordinates.

2806. Proposed by R. E. MORITZ, University of Washington.

An anthropologist told me recently that large numbers of Russian peasants, whose knowledge of numbers is limited to multiplication and division by 2, employ the following method of multiplication which they were taught by a priest.

(1) Write the two numbers to be multiplied in the same horizontal line.

(2) Multiply the first number by 2 and write the product under the number so multiplied.

(3) Divide the second number by 2, discarding the remainder 1 when it occurs, and write the quotient under the number so divided.

(4) Treat the product and quotient thus obtained in the same manner as the original numbers. Continue this process until the quotient 1 is obtained.

(5) Strike out all the numbers on the left for which the corresponding numbers on the right are even.

(6) Add the remaining numbers on the left. Their sum is the required product.

Problem: Prove that this rule is correct.

SOLUTIONS OF PROBLEMS.

442. (Geometry) [1914, 156; 1919, 268]. Proposed by J. B. SMITH, Hampden-Sidney College.

If any three straight lines AD, BE, CF, be drawn from the corners of the triangle ABC to the opposite sides a, b, c, they will enclose an area. If Δ, Δ'' be the areas of the triangles ABC, DEF, show that

$$\frac{\Delta''}{\Delta}=\frac{(AF\cdot BD\cdot CE-AE\cdot CD\cdot BF)^2}{(ab-CE\cdot CD)(bc-AE\cdot AF)(ca-BF\cdot BD)},$$

where the signs of the factors are to be determined by the following rule: Each segment being measured from one of the corners of the triangle ABC, along one of the sides, is to be regarded as positive or negative according as it is drawn towards or from the other corner in that side.